DOCUMENT RESUME

ED 372 735 IR 016 672

| | |
|---|---|
| AUTHOR | Olsson, Micael |
| TITLE | Institutionalizing Radio Science in Papua New Guinea: A Response to Teacher Demand for Interactive Radio Instruction. LearnTech Case Study Series No. 2. |
| INSTITUTION | Education Development Center, Washington, DC. |
| SPONS AGENCY | Agency for International Development (IDCA), Washington, DC. Bureau for Research and Development. |
| PUB DATE | Apr 94 |
| CONTRACT | DPE-5818-C-00-0044 |
| NOTE | 42p.; For case study no. 1, see ED 371 715. |
| AVAILABLE FROM | Education Development Center, 1250 24th St. N.W., Suite 300, Washington, DC 20037. |
| PUB TYPE | Reports - Descriptive (141) |
| EDRS PRICE | MF01/PC02 Plus Postage. |
| DESCRIPTORS | Curriculum Development; Developing Nations; *Distance Education; *Educational Radio; Educational Technology; Elementary Secondary Education; Financial Support; Foreign Countries; *Program Development; Science Instruction; *Teacher Attitudes; Teacher Role; Technological Advancement |
| IDENTIFIERS | *Interactive Radio; *Papua New Guinea |

ABSTRACT

The rising demand over the past 2 years for interactive radio instruction (IRI) in Papua New Guinea has been unexpected and has come primarily from educators who have seen the difference it can make in the classroom. This enthusiasm was unexpected because it was not clear at the end of the Papua New Guinea Radio Science Project in 1990 how extensively funding cuts had affected its impact. Since then the government and educators in Papua New Guinea have asked for other core material to be adapted for radio broadcasts. Teacher demand is playing a vital role in the overall institutionalization of IRI in Papua New Guinea because planners recognized its importance in the change process. Because the driving force is coming from teachers, the process is moving beyond the institutionalization of interactive radio to the institutionalization of interactivity itself. The adoption of the interactive character of the Radio Science program as the standard for all school radio instruction is beginning in Papua New Guinea. (Contains 11 references.) (SLD)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

ED 372 735

# INSTITUTIONALIZING RADIO SCIENCE IN PAPUA NEW GUINEA:

# A RESPONSE TO TEACHER DEMAND FOR INTERACTIVE RADIO INSTRUCTION

## LearnTech Case Study Series No. 2

by Micael Olsson

April 1994

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

IR016672

BEST COPY AVAILABLE

*The design on the cover is tapa cloth from Tufi in the southeast Papuan region of Papua New Guinea. Tapa cloth is made from pounded tree bark and was traditionally used for clothing, blankets and cereminial exchanges. The rich orange, brown and cream tones are common to tapas made in the Tufi region.*

*All photo credits belong to Micael Olsson.*

*For more information, contact:*

*Education Development Center*
*1250 24th Street, NW*
*Suite 300*
*Washington, D.C. 20037 USA*
*tel: (202) 466-0540*
*fax: (202) 223-4059*

*This document was drafted for the Learning Technologies for Basic Education project, which is implemented by the Education Development Center and funded by the Bureau for Global Programs, Field Support and Research, United States Agency for International Development, Bureau for Research and Development, Office of Education under contract DPE-5818-C-00-0044.*

## *Acknowledgments*

I am particularly indebted to the community school teachers and headmasters who were so warm and enthusiastic in taking the time to talk with me about their experience with interactive Radio Science, often when they had little or no advance notice. They, along with the various Papua New Guinea Department of Education officials and others included on the list of people interviewed, contributed substantially to the direction this publication has taken. Paul Mungul, the Radio Producer in the Department's Curriculum Unit, was especially helpful in facilitating arrangements for interviews.

I would also like to express much appreciation to Andrea Bosch, James Hoxeng, and Michael Laflin for their thoughtful feedback on earlier drafts.

# Table of Contents


*Overview* 7

*Background* 8
- *Cultural and Geographic Diversity* 8
- *Needs in Community-based Education* 9
- *History of School Broadcasts in PNG* 10
- *Evolution of IRI* 11
- *Institutionalizing Interactivity* 12

*A Gradual Process of Change* 13
- *Institutionalization in Stages* 13
- *A New Profile for Radio* 15
- *Radio Science Creates a Standard* 16

*A Bottom Up Process* 17
- *Teacher Response to Interactivity* 18
- *Structured Sequencing* 18
- *Interactivity as Active Learning* 18
- *Use of Inquiry* 20
- *Incorporating Hands-On Activities Into IRI* 21
- *Learning Gains* 22

*Valuable By-products* 23
- *English for Science* 24
- *Multi-media Support* 26
- *Teacher Training* 26

*Increasing Professional Motivation* 28
- *Advocates within NDOE* 28
- *Reception* 30
- *Materials Distribution* 31

*Next Steps* 32
- *Expanding IRI to Other Core Subjects* 32
- *Further Staff Training* 32

*Summary* 33

*Endnotes* 37

*Interviewees/References* 39

## *Overview*

The rising demand over the last two years for interactive radio instruction (IRI) in Papua New Guinea was unexpected and has come primarily from enthusiastic teachers and headmasters who see the difference it can make in the classroom. There is increasing appreciation for the net effect of its multi-media approach: visual images, print, the radio, the teacher, and the students all interacting in a coordinated way in the delivery of the lesson. Teachers are quick to point out the contrast between the passive rote learning used in older broadcasts and the active involvement of both teacher and student with IRI. They are impressed with the way IRI incorporates hands-on demonstrations and follow-up exercises that link the lessons to what the children already know about the things around them in their local setting. They appreciate the shift in emphasis from the accumulation of facts and figures toward improvements in students' thinking processes. And they are outspoken about the improvements in exam results they attribute to the interactive Radio Science methodology.

This enthusiasm was unexpected because it was not clear at the end of the Papua New Guinea (PNG) Radio Science Pilot Project[1] in 1990 how much the funding cuts experienced during the final stages of the project might affect its long-term impact. Since the conclusion of the project-funded activities in 1990, however, the PNG Government has raised the profile of radio, installing a powerful new transmitter and restoring eroded capacity. At the same time, the National Department of Education (NDOE) approved policy decisions critical to the institutionalization process: first to broadcast Radio Science nationwide and then to adopt Radio Science as the official curriculum for science.

In 1991, the Education Sector Review called for a revision of educational broadcasts, prompting the Education Broadcast Advisory Committees (EBAC) to commission a survey that found that a strong majority of teachers and headmasters want other core subject material adapted for use with the interactive radio methodology. In anticipation, a new staff structure incorporating scriptwriters, technicians, and producers has been submitted to the Department of Personnel Management and approved, pending the allocation of funds.

Where teachers have had some brief training or orientation to the

method and materials, they are quick to see the benefits of the approach. Teacher response is a valued consideration in education innovation in Papua New Guinea and the rising demand from teachers and headmasters is beginning to filter up through the system. It is this rising teacher demand, together with the upgrading of NBC, the results of the sector review and the EBAC study, the good professional development, and the inadequacy of the existing material that accounts for the steady progress of institutionalization to date.

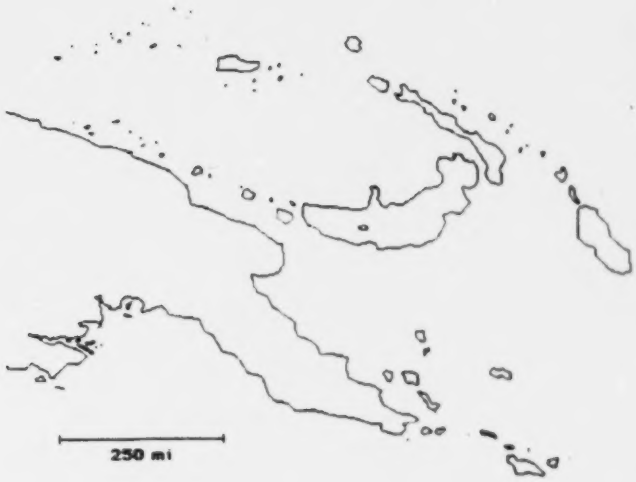
It is now up to the Education Broadcast Working Committee to pull together the results of the survey and related evaluations and reports and develop a submission for the Advisory Committee which is expected to outline steps for extending IRI to other core subject broadcasts.

## *Background*

### *Cultural and geographic diversity*

Papua New Guinea's incredible diversity is both cultural and geographic. Some 840 linguistic groups give its 4 million people perhaps the world's richest cultural diversity. Geographically, the main island's surprisingly rugged terrain rises to alpine heights of more than 14,000 feet, with scores of lesser tropical islands spread over vast distances. Independent since 1975, the young nation has made great strides in harnessing its rich human and natural resources to meet the broad development objectives of the constitution. At the same time, however, significant challenges remain in providing the infrastructure and services that this process requires.

The Government's policy of universal primary education is a case in point. 85% of the population live in rural villages where, not long ago, parents chose to keep at least some of their children at home to help with subsistence gardens. Times have changed, however, and heightened awareness regarding the benefits of education has greatly increased the pressure for more classroom space and a higher standard of instruction for both the urban and rural populations. There are currently 2300 community schools in Papua New Guinea with an enrolment of 300,000 children.




***PNG's four million people have 840 language groups and are spread over a mountainous mainland and outer islands.***

For many years, education in Papua New Guinea was geared toward fulfilling critical manpower needs for wage employment. Demand for secondary school graduates was high through the pre- and post-independence period but the situation reversed in the early eighties. Since then a high percentage of current graduates contribute to the urban drift of unemployed or have simply returned to their villages, ill-prepared to live off the land or sea.

### *Needs in community-based education*

One could also say that Papua New Guinea is extremely fortunate, however, since nearly all its land is communally owned by local villagers rather than the State. There is a need for education to contribute to developing the rich natural resources of local village communities as well as supplying the manpower needs for wage employment in the urban centers. Consequently, education policy now encourages strengthened ties between educational programs and local community life wherever possible.

The standard of teacher training has risen sharply over the years since independence. Many longtime teachers entered the system when the standards were much lower and lack the level of training required to meet the rigorous demands of the current syllabus. Resources dedicated to in-service training are very

limited. For most teachers, English is a second or third language so the medium of instruction is frequently an added burden as well. Books and other resource materials available in the average classroom are sparse and the distribution of new or reprinted materials, when they do become available, is hampered by logistical problems and peoplepower shortages.

## *History of school broadcasts in PNG*

Poor transportation infrastructure, limited training opportunities for teachers, and minimal teaching aids in the local classroom provide the historic rationale for the use of radio to support classroom instruction in PNG. The Schools Broadcast Section of the Department of Education has been airing a variety of broadcast lessons for many years. The first lessons, written for Australian Dual Curriculum schools in PNG, were later rewritten for the "Territory" Curriculum schools around the time of independence. While radio penetrates deeper than the other media throughout the country's high valleys and remote islands, it has certain limitations as well. Transmitters have sometimes been inadequate in strength or have been allowed to fall into disre-

***Radio reaches into PNG's high valleys and remote islands more easily than other media.***

pair. Schools have sometimes purchased inferior radios or have needed help putting up antennae. The result has been a history of poor reception, for at least some parts of the country.

It is in this context that an agreement was reached between the Education Development Center (EDC) and PNG's Department of Education to cooperate in the research required for developing an innovative radio-based instruction system for science at the primary level. The project was to be a pilot study adapting the interactive radio methodology for use with science. IRI for science was expected to incorporate new styles of inquiry and more hands-on teaching methods than had been used with the interactive radio lessons previously developed for mathematics and language arts.

## *The evolution of IRI*

The classic style of IRI was developed for mathematics in Nicaragua by professionals who had done extensive research in computer-aided instruction, adapting it to a radio-student format using the guiding principles of active learning, distributed learning, rigorous design, and reinforcement[2]. Mathematics was well suited for the resulting rapid exchange of questions and answers between the radio and the students.

In keeping with the language learning theory of the day, extensive use of drill and repetition was again used to adapt IRI for language arts in Kenya. Even with language arts, however, the program developers found that the format of interactivity needed to be adjusted to meet the special needs of a language curriculum[3].

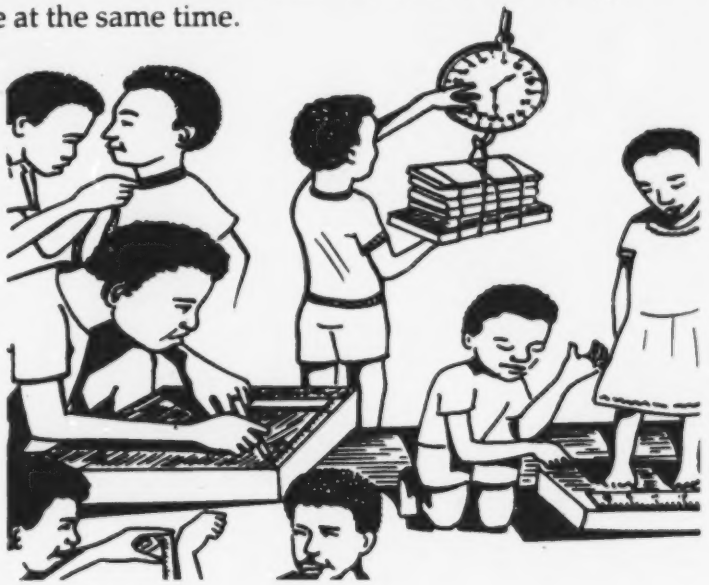
Science pedagogy, on the other hand, is fundamentally different from either mathematics or language arts. Conventional science teaching is not as preoccupied with memorizing or repeating procedures, nor does it lend itself as easily to the drill and practice of factual elements. Science is more focused on problem solving and conceptual knowledge drawn from observation, experimentation, and discovery.

In addition to these differences, the Department of Education in Papua New Guinea was anxious to have the teachers play an important role and to have their knowledge of science strengthened in the process[4]. In Nicaragua, teachers had to cope with multigrade classrooms and often attend to other students while one group followed the Radio Mathematics lesson. There was

little involvement of the teacher in that initial format of interactivity. Teachers began to play a greater role in IRI as early as the Kenya project, but not to the level being required of Radio Science in PNG.

The challenge for Radio Science, then, was not only to incorporate hands on demonstrations and experiments with greater use of inquiry, but to adapt the style of interactivity itself to make it more amenable to such an instructional process and to do it in a way that both involved the teachers and enhanced their knowledge of science at the same time.

***Radio Science incorporated new styles of inquiry and hands-on methods.***



### *Institutionalizing interactivity*

It was anticipated that the resulting interactive science lessons could be used both in PNG and, with some modifications, in other countries that have similar educational objectives and resources. Importantly, while this pilot study was not designed to support full institutionalization on a national scale, project objectives did include training a group of PNG nationals in skills needed to carry out on-going primary science radio education following the study. Funding cuts curtailed project activities during the final year of the project, leaving some uncertainty as to what long-term impact the project might have.

It was somewhat surprising, then, to learn recently that the primary recommendation in a departmental study reviewing

schools broadcasts in Papua New Guinea called for the expanded use of IRI *with all school broadcasts.*

"All the school broadcast programs should be reproduced using the Interactive Radio Instruction method that was used in the Radio Science programs which are now on air. Using the Interactive Method would greatly assist the child's learning and at the same time the child would be actively involved throughout the duration of the broadcast. This has proved to be successful with the current Grade Six Radio Science programs. It is recommended that the possibility of using the Interactive Radio Instruction method for all the programs be further investigated by the National Department of Education." [5]

Interactive Radio Instruction has taken root and the institutionalization of Radio Science has moved steadily ahead in spite of difficult circumstances. This case study, then, will attempt to explore just what it is about the interactive approach that has led to the support it has received in PNG and, at the same time, to trace the internal path along which institutionalization is proceeding.

## *A Gradual Process of Change*

### *Institutionalization in stages*

While Radio Science was a pilot project, one of the original project objectives was to "train a group of PNG nationals in skills needed to carry out on-going primary science education." [6] Interest in institutionalizing Radio Science was weak in the early stages but has gradually gained momentum.

One NDOE official set the tone early on when he cautioned:

> *"Innovations within Education are necessary for improving the overall standard of education in the country. However, innovations have followed one after another year after year, creating frustration among the teachers and strain on the system as it struggles to adapt materials and training programs with very limited resources. This being the case, it is important that Radio Science be sympathetic with NDOE's perspective of long-term goals and its preference for gradual, systematic adjustment of its programs."*

The tone of admonition here may have been due, in part, to the sense of local ownership for the project that had begun to emerge among the national staff at that stage. Through the professional development process, staff had become convinced that the interactive radio methodology they were using was well suited to the PNG context and that the co-teaching between the radio and classroom teacher could make a significant difference in the quality of primary science instruction PNG children would receive. The solidarity being built up over this period may have seemed too enthusiastic during the early development stage, but it has become an important element in the ongoing institutionalization of Radio Science because it left behind a core of outspoken advocates who have been able to nudge the process forward as appropriate occasions presented themselves.

The general feeling within NDOE had been to move slowly and to look at the initial Radio Science pilot project as the first of several stages in an extended exercise that might take 10 or 15 years to complete. Full institutionalization, according to some of these officials, could well be realized though a series of subsequent proposals that might be funded through more than one agency. At a 1989 meeting of the national Community Schools Board of Management, the discussion around institutionalization was similarly guarded. They expressed:

- reservations regarding the costs associated with producing and replacing workbooks for every pair of Grade 4, 5 and 6 science students;
- reservations regarding centrally purchasing and distributing additional science kit material; and
- satisfaction with the decision to shift toward producing more teacher-directed support material.

While there was interest in adopting the IRI approach for science, there were still serious questions about whether it was really practical for PNG given the add-on costs that it would entail. Yet institutionalization has proceeded at a steady pace since that time. *To what then can we attribute the sustained support that institutionalization requires, especially in such a climate of caution and reservation?*

Several factors have worked together to raise the profile of Radio Science and to support the level of institutionalization that has subsequently been achieved. These include:

- the higher priority radio now enjoys as a medium for the delivery of development services;
- the call in the Education Sector Study for a review of education broadcasts;
- the impact of the interactive inquiry approach in the classroom and the resulting support of the teachers;
- the in-service workshops; and
- the quality of the professional development carried out during the production stage.

***PNG is revitalizing its National Broadcasting Commission to meet the country's communication needs.***

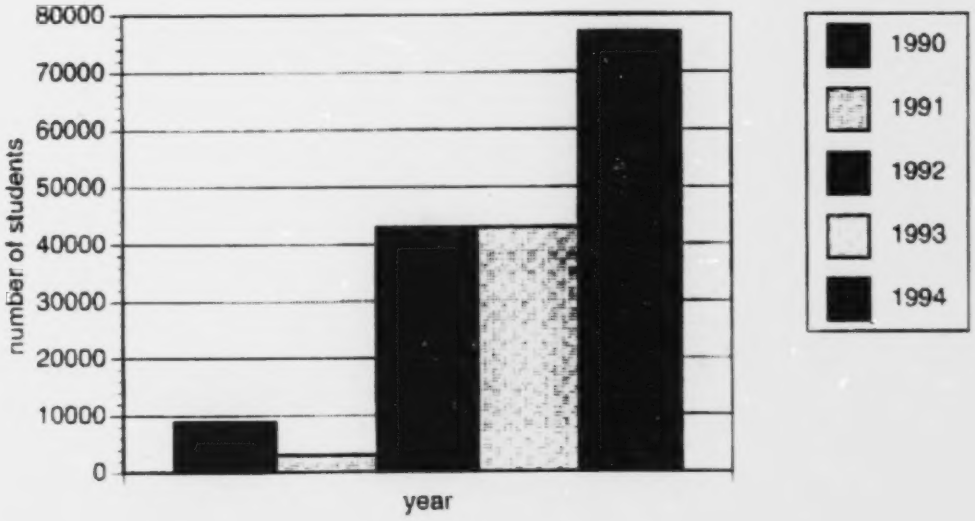
### *A new profile for radio*

For several years, the severe budget cuts experienced at the NBC were an indication of where it stood in terms of government priority. Today, however, the grounds are well-kept, the buildings are repainted, and the mood has changed. Educators are especially pleased that the new Director at NBC is himself a former First Assistant Secretary (FAS) from NDOE and many feel his leadership will contribute further toward improving the quality of the school broadcasts.

Three education positions at NBC, phased out during the earlier

budget cuts, have once again been restored. The powerful new transmitter, itself symbolic of a new level of commitment to the medium of radio, provides a much stronger signal for addressing the country's distance communication needs. NBC and the Schools Broadcast Unit in the Curriculum Development Division are busy collaborating on the development of new scripts for another broadcast series. All in all, there is a noticeable shift in attitude away from television and print and toward radio as a more effective medium for reaching the rural majority in Papua New Guinea.

By the end of the Radio Science Pilot Project in 1990, access to the new approach had been extended to some 9000 students. Once the Grade Six materials began to be broadcast nationally in 1992, access expanded to more than 40,000 students. The introduction of the Grade Five Science broadcasts in 1994 means that some 75,000 students now have access to Interactive Radio Science broadcasts.




## *Radio Science creates a standard*

The Radio Science lessons stand out alongside the other school broadcasts because of the effective new approach and because they do support the current syllabus.

The Education Broadcast Advisory Committee (EBAC), which includes the Secretary for Education, the Assistant Secretary for Curriculum Development, and the Director of the National

***"All the school broadcast programs should be reproduced using the IRI method."***
***—School Broadcast Survey Report***

Broadcasting Commission has long been concerned about the quality and relevance of much of the schools broadcast material even prior to the publication of the sector review report. The syllabus changes with periodic reviews and yet the broadcasts have remained the same, in some cases for more than twenty years.

It may not be surprising given the renewed status of radio and the growing concern for improving the quality of school broadcasts generally that a decision was taken following the provincial pilots to broadcast Radio Science nationwide on NBC. In fact, the survey report points out that considerable publicity went into launching the broadcast nationwide, a sign of the strength of the official endorsement. A subsequent decision to endorse the Radio Science lessons as the official science curriculum rather than supplementary support for classroom instruction followed.

## *A Bottom-Up Approach*

Institutionalization in PNG has basically been a bottom-up process, driven by teacher preference for a kind of radio instruction they have found to be very helpful. When confronted with the need to review outdated broadcasts, NDOE's response was to take the matter directly to the teachers by way of a radio broadcast survey that included among its objectives a review of

current programs and recommendations on how to improve them.

It was predominantly the teachers, following their experience with the IRI approach, who used the survey as a means of calling for the use of the methodology with all school broadcasts in PNG.

*Teachers see how involving students in practical demonstrations outside the classrooms links education to daily life.*

### *Teacher response to interactivity*

There are several aspects to the kind of interactivity used in the Radio Science lessons that have earned the respect of teachers and headmasters in PNG:

- Teachers like the carefully structured way in which the lessons move forward;
- Teachers like being involved themselves and they like the active way in which the children are involved;
- Teachers speak very highly of the multi-media approach that reinforces the message by integrating graphics, print, the radio, themselves, and the students;
- Teachers are impressed with the way the open-ended questions encourage students to really think through an idea; and
- Teachers see how involving the class in practical demon-

strations outside the classroom links education to their daily lives and makes the lesson come alive for them.

## *Structured sequencing*

Teachers especially like the way the simulated dialogue is organized, leading them one step at a time through the curriculum. They find that kind of sequencing difficult on their own, especially for technical subjects like science. They appreciate the radio taking the lead and providing a pathway without excluding them from the instructional process.

Lorna Pinor of Lakomiufa Community School puts it like this:

> *"The beauty of the Radio Science lessons is that they are brief and straightforward so that the students can grasp the concepts being taught. They actually get the idea... which has not been the case with the science material in the past. Teachers often pass over material either because they do not understand it themselves or because it is too complicated to try and break down into a sequence that is easily understood."*

## *Interactivity as active learning*

The style of interactivity developed for Radio Science with its focus on active learning has been a key factor behind its adoption in PNG. Teachers frequently contrast the Radio Science lessons with other broadcast lessons where the children passively sit back and listen. They see the children are alert in lessons where the interactive method is being used. Anne Kukuh, the Grade Five science teacher at Hisiu Community School in the Central Province, points out that

> *"...the lessons go well because the content of the lesson fits in with resource material available around the school. The children are active. There is so much they can do. They can answer questions, they can respond to the radio, to print, to pictures, to the demonstration, to the teacher, and to each other."*

This is the aspect that Radio Supervisor for School Broadcasts, Hitolo Abe, feels so strongly about and is trying to capture in rewriting some of the other school broadcast material.

> *"I think the Radio Science approach is much better because*

> *because the children really get involved. They don't just sit there and repeat what the radio says like so much of the other radio broadcast material. We are all agreed on that. That's why I've been trying to redo the Community Life lessons using the same method."*

## *Use of inquiry*

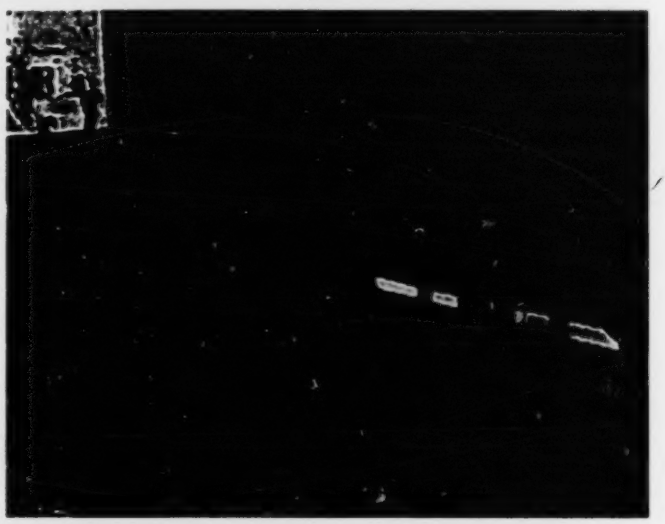
But it is not just the activity and excitement the teachers comment on. The simulated dialogue probes with the questions that are asked. Questions are asked in a way that allows more than one correct answer and that helps learners link the new concepts of science to their own experience of the world.

Headmaster Bernie Naiab refers to the inquiry approach when he says that

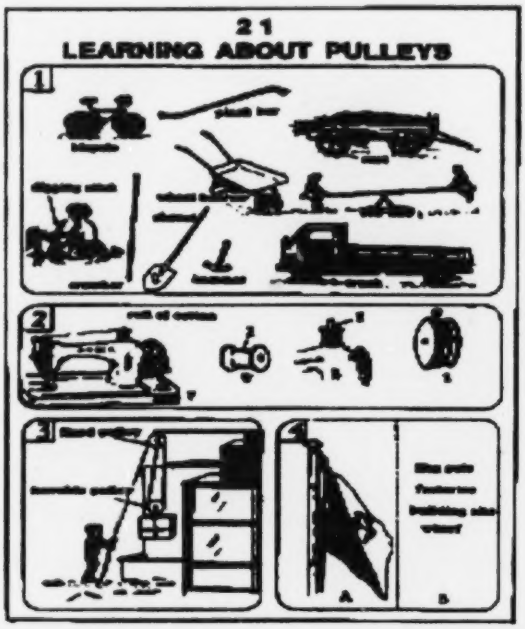
> *"Radio Science makes the students think and does it in a way that allows them to use what they already know from what is around them to answer the questions."*

To promote this kind of inquiry, the radio teacher affirms several possible correct answers, allowing a brief interlude of

***"The students are active...they respond to the radio, to print, to the activities, to the teacher and to each other."***
***—Anne Kukuh, Grade Five Science Teacher***



music during which the students have an opportunity to frame their own response. This is one of the challenges for adapting IRI for use with science. It is no longer possible to maintain the faster paced responses that have been used in earlier interactive radio lessons. The more reflective, open-ended questioning




***Hands-on follow-up activities were designed with schools in minds...with things like spades and pulleys that we can produce."***
***—Toni Gimi, Headmaster***

technique used in adapting IRI for science is critical to the subject matter.

NDOE's Science Curriculum writer, Harold Ure, is currently revising some of the Grade 4 lessons and tries to keep this mode of questioning central to his design.

> *"It takes the class beyond just repeating what they hear on the radio to really thinking and reflecting on the content."*

## *Incorporating hands-on activities into IRI*

Science also needs more hand-on activities than mathematics or language arts. To teach a subject like science, lessons have to guide students through specific activities designed to help them understand the concepts being taught. Not only does the pace of the simulated dialogue on the radio provide the time needed for more classroom activity, but the cost and distribution of the materials to be used for these activities must be addressed as well. Program designers found several pedagogically appropriate ways to accommodate the increased hands-on activity, varying according to the topic being considered. Frequently, a "dry lab" was used where the teacher went through a demonstration with the students during the course of the broadcast lesson but then waited until after the broadcast to help the students go through the activity itself.

Questions of cost and distribution for the recommended materials were more difficult to solve. It became increasingly apparent during the development stages of the project that the cost and distribution of science kits was going to be prohibitive. The result was a shift away from trying to use centrally purchased materials in the follow-up activities. Instead, an effort was made to limit the materials needed for exercises to items commonly available in the vicinity of local classrooms. Some of the earliest Grade 4 material is still being revised to effect this change.

Teachers report they have to be creative in order to allow the time needed for some of the follow-up activities and in order to put together the materials they need in advance. Teachers introduced to the methodology through in-service workshops clearly see the benefits to the approach both for themselves and for the students and happily make the effort to assemble materials and find the time for doing the demonstration.

Toni Gimi, Headmaster of Marinumbo Community School, explains:

> *"Many of the follow-up exercises have been designed with the circumstances of schools like this in mind so that simple things like spades and pulleys... that we can produce... are all that we need to perform the experiment. Only occasionally will we have to leave out an exercise because we are unable to put together the materials needed. The time constraint is often more of a difficulty to us now than the equipment needed."*

Teachers enjoy being able to apply the principles being taught in the classroom to real life situations with which the students are familiar outside the classroom. They see that it makes the lesson come alive and holds the interest of their students who then learn more as a result. This has created an opportunity to apply the education policy encouraging links between educational program and local community life.

## *Learning gains*

While no statistical analysis is yet available, a number of schools are reporting improved results in their Grade Six exams and attribute this to the new Radio Science approach, although this is coming primarily from those schools that have had the opportu-

nity to be introduced to the Radio Science materials.

Headmaster Renagi Ralai at Asaro Community School sees Radio Science making all the difference:

> *"The exam results for science at this school have risen sharply since the introduction of Radio Science here. This is clear evidence to me that Radio Science has been a great help to us."*

Another headmaster, Igo Onafimo took part in the same Eastern Highlands in-service workshop and notes a similar impact:

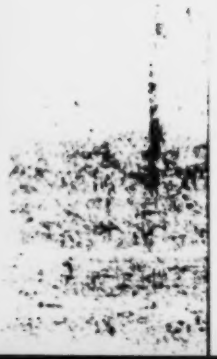
> *"We are a Level IV Lutheran Agency school and strongly support the Radio Science program. I personally took the Grade Six Science class at the Lufa Community School so I know how effective it can be. We have done very well here in the Eastern Highlands on our combined subjects exam since the introduction of Radio Science... 32 and upwards. We have three exams... English, math and combined subjects which includes science. One of our students got 45/45 and two got 42/45. The reason is the Radio Science broadcast."*

*"Radio Science is not just a supplement. It is now our science curriculum."*
*—Godfrey Yerua, Assistant Secretary, Curriculum Division, NDOE*

## *Valuable By-products*

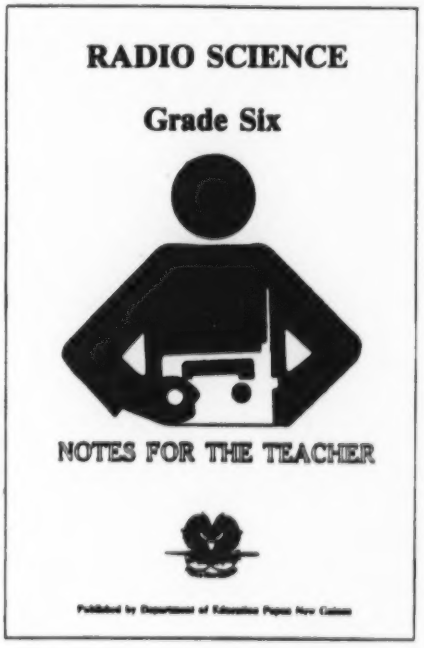
Not only do teachers appreciate the interactive methodology for its structured sequencing of the material, for its multi-media approach, and for its style of inquiry, but other elements are important to them as well. These include:

- the help it provides in teaching English;



- ❖ the upgrade it gives their own science training; and
- ❖ the way it minimizes the daily preparation time they must allocate to science.

*"With the teacher's guide and the student handbooks...we hear the radio actors, we the illustrations and we have the basic ideas in print."*
*—Elizabeth Oa, Grade Five Science Teacher*




### *English for science*

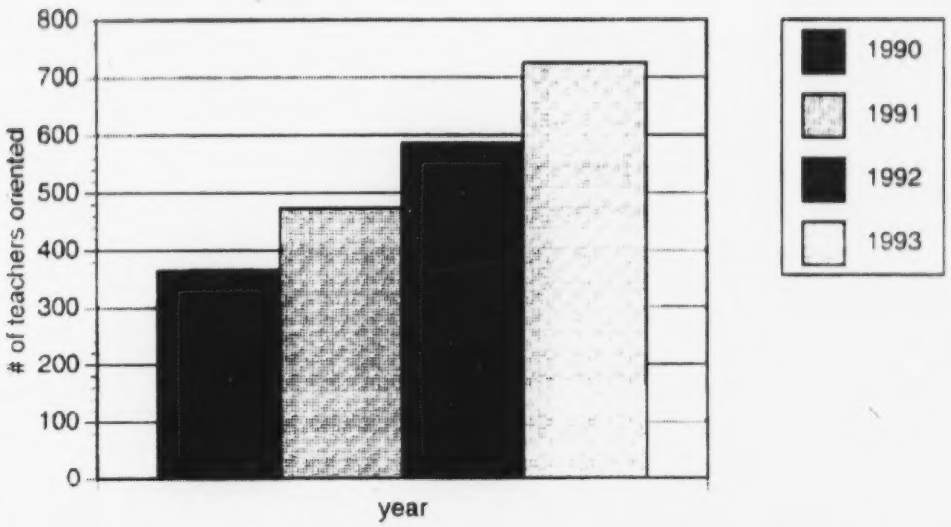
Appreciation for the structure and sequence of the lessons also comes through in one of the other reason teachers like Radio Science. The demand for good teaching aids to teach English is high in Papua New Guinea and yet resources available to teachers are limited. Over and over again, teachers are reporting that Radio Science, with its multi-media approach, helps them in teaching English. New ideas are introduced in sequence and carefully reinforced in a variety of ways between the print materials, the radio, and the guided teacher and student participation. Students have the correct spelling in front of them and hear a good pronunciation of the words through the radio. The pictures and follow-up exercises reinforce the meaning.
The former Radio Science staff evaluator, Roland Katak, identified with the strong sentiments of the teachers on this point:

> *"It was clear wherever I went during the evaluations that the teachers loved Radio Science. 75% of the teachers accepted Radio Science enthusiastically. They liked it for science but*

*they also liked it for English, because the methodology turned out to be an excellent means of teaching English as well as science. As we all know, some teachers still use Tok Pisin in the classroom because of their own struggle with English.*

*"What happens with Radio Science, in such cases, is that the children often wind up interacting with the radio and helping the teacher with her English in the process. The teachers pick up quite a few things as long as no one is around to laugh. This is especially true for things like word order and sequencing. Hearing the radio reinforces things you once knew but hadn't been paying attention to. If you get out to the urban centers you have a chance to hear better English, but for many of these teachers, that doesn't happen. Radio Science provides an excellent opportunity for them to improve their own language skills without embarrassment."*

Of the 4000 teachers who teach science, some 370 became familiar with the IRI approach through the pilot project. Since then, in-service orientation workshops have gradually expanded that number.




However, word quickly spreads about the usefulness of the method not only within a school where one of the teachers has been to an in-service workshop, but to neighboring schools. Teachers reassigned at the end of the year extend support broadcast survey in spite of the fact that less than one quarter of the science teachers have had the benefit of any orientation to the

new approach. Accelerating the pace of teacher orientation could further increase teacher demand and step up the pace of institutionalization.

## *Multi-media support*

Teachers in PNG feel very strongly about the advantages of having printed support materials that are in line with the syllabus. So often they feel they are on their own, inadequately prepared, and left with few or no resources. To make matters worse, most of the school broadcasts in Papua New Guinea are now out of date. While the school broadcasts were meant to support and reinforce the syllabus further, much of the material currently being aired is no longer in line with syllabus objectives.

It is understandable then that the combination of text and illustrations, carefully integrated with the radio, comes as a welcome relief especially for one of the more technical subjects.

> *"It is the combination of the print and the pictures along with the radio,"* says Helen Herepe of Manto Community School, *"that makes Radio Science so helpful in the classroom."*

## *Teacher Training*

The survey results make it clear that teachers find the Radio Science materials *much easier to use* than the previous science broadcast material. But many of the teachers also point out that, like English, they are learning science at the same time the students are learning science and that they are comfortable with this because it is handled in a way that does not embarrass them in front of their colleagues. This is widely recognized within NDOE and is one of the reasons that Radio Science has earned the level of respect and support that it has today.

Teachers like Mark Sipio of Manto Community School, who had the opportunity to participate in a regional in-service workshop introducing Radio Science, feel very strongly about the help it provides the teacher.

> *"Radio Science is really a breakthrough for primary education in Papua New Guinea. If only something like this had reached us when I started teaching 18 years ago.*

*There has never been anything like this for us teachers. Many of us have had very limited training and we don't have time to prepare lessons each day, but this method makes it manageable for us. We need it for other subjects too, especially English. But you know, we teachers are just like anybody else. We'll avoid something if we think it is too hard for us. What made all the difference for us was the in-service training that was put on in West Goroka in 1992 to introduce us to Radio Science. Just that brief introduction gave us the confidence that this was something we could do and that made it easy for us to get started."*

In spite of the wide publicity given to launching Radio Science lessons on a national scale, Paul Mungul, the Radio Producer in the Schools Broadcast Unit, is aware that enthusiasm for the Radio Science approach is much higher where teachers have had some orientation to the new methodology.

*"We have run brief in-service workshops for teachers in Milne Bay, Eastern Highlands, New Ireland, and Morobe. In those places and in the pilot schools that got special attention during the developmental stages, there is great enthusiasm for interactive radio. They find it both easy and very helpful. But that is because they have had some introduction to the method and the materials. When the broadcast went nationwide on NBC, however, we really should have taken steps to introduce teachers to the differences between this methodology and the old one, rather than*

***"The School Broadcast Unit's new staff structure with scriptwriters, producers and technicians has now been approved by the Department of Personnel Management."***
***—Paul Mungul, Radio Producer, NDOE***

***"It is immediately obvious that the combination of the interactive radio instruction, the classroom teacher and the support materials greatly enhances the learning experience."***
***—Peter Baki, Deputy Secretary, NDOE***

*simply starting the broadcasts on a national scale and sending out all the material. Broadcasts in the past have been supplementary material and these will be treated the same way unless the teachers know otherwise."*

Paul continues to run as many in-service orientations to IRI and the new Radio Science lessons as funds will allow. He also points out, however, that two audiocassettes produced during the development stage for teacher training provide another important option.

*"Most teacher's own radio-cassettes and the schools can use their subsidy to pay for [the cassettes]. In fact, teachers seem to be much more willing to pay for items like this now than they were in former days when everyone expected such materials to be supplied at no cost. Some further effort is required, however, to make sure that all teachers and local boards of management, even in the most remote areas, know that these audiocassettes are available."*

## *Increasing Professional Motivation*

### *Advocates within NDOE*

The quality of the professional development provided to the Radio

Science staff is another important factor. Both the radio technician and the radio producer received extensive professional training in the area of radio production. The Science Curriculum Writer received at least two months of professional training under the former director of an NSF-funded elementary science curriculum project. The scriptwriters benefited from extensive training under two specialists, one for two months and another providing a full year of follow-up training. Four other visiting specialists provided excellent advice on all aspects of interactive radio as well.

There was another sense, reports Frank Watson, a former project director, in which

> *"the Radio Science project became a 'learning community' where everyone from the driver to the director were expected to learn new ideas and to share the weight of the project's work. All were part of the professional development experiences. All learned each others jobs and at time did things beyond the job title they had." At the end of the project, then, the staff felt they 'owned' a project that was going to contribute to the children of PNG. They still own the project and in their own ways work to keep the project alive."*

This accounts, to some degree at least, for the development of a core of advocates for Radio Science within NDOE who lends its support at critical moments in the institutionalization process. Such advocacy would have played an important role in getting the lessons broadcast nationally on NBC, in getting the new positions approved to support the production of further school broadcasts, in getting Radio Science adopted as the official curriculum, in getting Radio Science materials printed under recurrent budget line items, and in the revision of policy on subsidizing radio purchases, all important aspects of the unfolding institutionalization process.

Paul Mungul confirms that the Schools Broadcast Unit did indeed develop a new structure that incorporates scriptwriters, technicians, and producers into the unit and that this revised structure has since been approved by the Department of Personnel Management, pending allocation of funds. The Grade Five science materials, the first to be produced under recurrent budget line items, were slow in getting

through the system. But the important precedent here is that they have now been printed under recurrent budget votes and are currently being distributed as an integral part of DOE's materials distribution system.

## *Reception*

The schools broadcast program has long struggled with the challenges of ensuring that all schools have radios and batteries and that the reception is good enough to receive the signal during classroom hours. It is true that some teachers still complain about stolen radios, lack of batteries, or poor reception, but there is a noticeable shift in perspective on these issues in schools where teachers have had some introduction to the methodology.

These schools see the value of the programs and show more resolve in solving radio, battery, and reception problems than schools who have not had that exposure and perceive Radio Science as just another typical school radio broadcast. Teachers bring in their own radios for use with Radio Science, for example. They may buy their own batteries if the Board of Management takes too long to organize them. Some even make sure they get help in hanging an antenna. For them, Radio Science is a resource and they want to take advantage of it.

These issues are also receiving attention from the central administration. The new transmitter makes a big difference, but the problem of school radios disappearing has also been addressed with a practical innovation that allows joint ownership of radios by schools and teachers. Past practice has been that teachers use the school's radio both personally and professionally and often wind up taking it with them when they move to a new assignment. The Government purchases many radios as a result. Under a new arrangement teachers must first buy the radio themselves and then turn in their receipt to the Department after which they will be reimbursed for half the amount.

A policy decision taken to help schools who still have reception difficulties was to subsidize the reproduction of the Radio Science lessons on audiocassettes. Motivated schools are now in a position to use their central subsidy funds to purchase a full set of the cassettes.

***"We are trying to use IRI to rewrite our Community Life series and then move on to other core subjects."***
***—Jocelyn Patterson, Education Officer, NBC***

### *Materials distribution*

The distribution of materials has been a source of frustration for educators in PNG for many years. The spread of the impact of the Radio Science innovation is limited by this larger administrative concern, but here again teachers and administrators who have experienced the advantages of Radio Science are more apt to be resourceful in finding ways around the difficulties.

The guidelines call for one copy of the student workbook to be distributed for every two students along with a teacher's guide for each teacher. Materials tend to get as far as provincial education offices but rarely are repackaged and sent on to individual schools. The more general practice is for teachers to stop by the education office whenever they come into the regional center and pick up any materials that may have arrived. The result is that those who live the closest and come in most often receive their share and more. Those who come in late find that the supply has been exhausted.

Inevitably there will be teachers who are unable to receive their materials in a timely fashion under such a system, but the teachers who have had good exposure to Radio Science tend to be among those who make absolutely certain they get their materials promptly, as if they were watching out for their salary checks. Some make photocopies if they do not get their full

share. They are motivated because they realize how much it is going to help them.

## *Next Steps*

### *Expanding IRI to other core subjects*

What then are the next steps in the institutionalization of IRI in PNG? Deputy Secretary Peter Baki is quite straightforward about it.

> *"We are certainly interested in greater use of interactive radio. We are convinced of its value and are committed to greater use of radio in the classroom. We urgently need to upgrade our other broadcast materials. But we need help in developing the kind of educational technology interactive radio requires."*

Even though such professional development assistance is lacking at this time, work has begun on drafting new materials for the Community Life broadcasts and there is solid consensus that English should be next in line. This is confirmed not only by the eagerness of the teachers in trying to use Radio Science for English instruction but also by the survey results showing high percentages of teachers favoring a revision of the existing radio lessons.

Evaluator Tom Seta takes it further:

> *"There is a lot more we should be doing to use people like Paul Mungul and Harold Ore (Radio Producer and Radio Technician, respectively). We really have to do something about the other radio broadcasts. We are going to need more material packaged in the format we used for Radio Science and we are going to need a lot more regional in-service training. The week we currently allocate to national in-service training has not really proven effective. I think we can do a lot more by orienting teachers to specially packaged materials, like the Radio Science materials, through regional in-service training activities."*

### *Further staff training*

There are a number of people in positions that will be crucial to

the production of IRI materials for other core subjects who were not involved in the training or production of the Radio Science materials. These include the Radio Supervisor for Schools Broadcast, Hitolo Abe and the Education Officers at NBC who are now trying to collaborate in the production of interactive materials for the Community Life school broadcasts. Hitolo expands,

> *"We got all excited about trying to use the method for our Community Life broadcasts and we have managed to get through five or six lessons, but the enthusiasm is wearing thin now. It's just so hard. I'm not sure how some of us missed out on the scriptwriter training during the development of the Radio Science programs."*

It is clear that the training conducted during the pilot project was of excellent quality. Those who received the training speak highly of it. Harold Ure, for example, who was trained during the program and is currently finishing up the Grade 4 teacher's guide and student worksheets, speaks highly of his training experience. Lidia Oe is putting her scriptwriting training to use with educational TV and is very grateful for the IRI training she received. Paul Mungul and Patrick Ore feel much better prepared in their roles in production as well. Some have found positions in other divisions or departments.

But there is still a lack of trained scriptwriters in approved positions within the Curriculum Division to help develop new scripts for math, English, and community life. A program is needed that trains scriptwriters who continue in approved positions responsible for drafting and revising interactive scripts for use in the other school broadcasts.

## *Summary*

NDOE is clear about wanting to move ahead with IRI. *"We do not need any more studies on interactive radio,"* asserts Deputy Secretary Peter Baki.

> *"It is immediately obvious (given the situation in PNG) that the combination of the interactive radio instruction, the classroom teacher, and the integrated print materials greatly enhances the learning experience. What we need is assistance with education technology development. The next step is*

> *for the recommendations arising out of the Schools Broadcast Survey to be developed in the form of a submission and presented to the SBAC. NDOE will then make an effort to contact funding agencies for assistance in expanding their use of IRI."*

The PNG experience has demonstrated that interactive radio instruction can be adapted for subjects like science that require greater use of inquiry and more hands-on teaching methods. The questioning technique has been adapted to focus on more open-ended questions. There has been less use of drill and repetition although distributed learning still plays an important role. The increased hands-on activities have been profitably used to link the lesson to the student's world of experience outside the classroom. Limited broadcast schedules have accommodated the extra activities by organizing the instruction in two parts: the first part guided by the radio with a subsequent review led by the classroom teacher following the broadcast.

Two fundamental shifts took place simultaneously when IRI was being adapted to teach science in Papua New Guinea. First, the lesson had to accommodate the hands-on demonstrations and experiments important to science. But, beyond that, there was another shift taking place towards constructivist approaches to teaching science. The classic model of Radio Mathematics in Nicaragua was generated by creative minds applying behaviorist approaches to radio learning. Subsequent applications adapted the IRI model to teach language arts. But the Radio Science project went further to develop a new kind of interactivity in the design of the Radio Science lessons, focusing on improvements in students' thinking processes rather than the accumulation of facts and procedures. The new demand by teachers for IRI in Papua New Guinea may be as much a response to the constructivist approach as it is to the classical benefits of IRI.

While a number of circumstances have converged to support the institutionalization of Radio Science in PNG, its sustained progress is largely due to growing demand from teachers and headmasters. That demand issues both from the inadequacy of existing materials and methodologies and from an alternative that works and is easy to use.

But the dominant role teacher demand is playing in the overall institutionalization of Radio Science and IRI in PNG needs further explanation. The SBAC responded to the Sectoral Study's call for a review of school broadcasts by going to the teachers who, they say, are the closest to the situation and know what needs to be changed. This respect for the teachers' point of view reflects an egalitarian ethic common throughout PNG, a nation whose government officials are only one generation removed from the traditional values of village life. Everyone is seen to have a store of knowledge accumulated through life experience and a contribution to make based on that know-how. Within education, this is realized as a natural predisposition to value the teachers' perspective on matters like the strengths and weaknesses of school broadcasts. It was the teachers then who were consulted and they were the ones who had developed the strong convictions about the effectiveness of Radio Science and IRI. Their response then began to move up through the system.

NDOE administrators, after long experience dealing with a series of other innovations, have come to understand the central role teachers play in effecting change in the classroom. They cautioned Radio Science administrators early on that the pace of institutionalization would be dependent on the rate of teacher adoption and could not be scheduled like other project objectives. Teacher demand, with the time lapses required for that demand to diffuse throughout the system, has become a recognized variable in the change process.

The professional quality of the staff development component of the project left a core of advocates for Radio Science within NDOE, but their calls for steps toward institutionalization could be viewed as self-serving were it not for concurring signs of teacher demand coming up from local classrooms. It is the convergence of support throughout the system *with* classroom teacher demand that has provided the momentum to keep the process of institutionalization in motion. The upgrading of NBC, the sectoral review, the SBAC study, the advocates within NDOE, and the inadequacy of existing materials all gain relevance as contributing factors when backed by strong teacher demand.

The institutionalization of Radio Science in Papua New Guinea has been relatively slow but steady, triggered by an educationally sound learning technology whose value was immediately appar-

ent to teachers and headmasters with some exposure to the approach. The support of that cadre of teachers and headmasters in the field, complemented by the efforts of a few committed advocates within NDOE, has kept the process in motion. Because the driving force comes from teachers responding to the relevance of IRI in the classroom, the process is rapidly moving beyond the institutionalization of Radio Science to the institutionalization of interactivity itself. Not only is Radio Science being adopted as the mode of instruction for science, but a much larger process of adopting the interactive character of the approach as the standard for all school radio instruction in PNG is in motion as well.

## *Endnotes*

1 The Radio Science Project was an experimental educational radio project, located in Papua New Guinea and funded by USAID from 1987-1990. The Radio Science Project worked in cooperation with the Papua New Guinea National Department of Education with the primary purpose of exploring the use of radio to teach the national community school science curriculum to upper elementary school children (Grades 4, 5, and 6). The project used interactive radio instruction methods to involve children in the radio lessons. Interactive radio uses techniques that prompt responses from teachers and children during the broadcast of the radio lessons. These responses range from the answering of questions to the use of materials during the lesson.

Papua New Guinea was selected as a host country for the project because of the government's interest in the use of radio to get science instruction to large numbers of children and teachers throughout the country. Even though science is a required subject in the community school curriculum, most teachers do not teach it due to a lack of materials and/or a lack of training.

A national project staff, working together with a director/science educator and radio producer from the United States, wrote and produced the project radio lessons and supplementary materials. The project produced 60 radio lessons for each grade level (4, 5, and 6). The radio lessons are 20 minutes in length and are broadcast to schools twice a week. The broadcast lessons are supported by a 10-minute classroom lesson conducted by the teacher directly after the radio broadcast. This supplies 60 minutes of science instruction per week to children in Grades 4, 5 and 6. --- "Memorandum of Agreement Between the Government of Papua New Guinea and the Education Development Center", USAID, March, 1986.

2 Moulton, Jeanne, "Interactive Radio Instruction: Broadening the Definition", p.15.

3 Imhoof, Maurice and Philip R. Christensen, eds, *Teaching English by Radio: Interactive Radio in Kenya*, p.30

4 Education Development Center, *Radio Science Project 1989-1990*, p.2

5 Schools Broadcast Survey, Research Report, [pp.9-10]

6 Memorandum of Agreement Between the Government of Papua New Guinea and the Education Development Center, p.4.

7 Betuel Peril, former Deputy Secretary, NDOE, personal communication.

8 Sector Review Report, 1991, Volume 2, p.199.

9 Seta, Tom, "Radio Broadcast Survey Report", 1992, p.2.

10 Ibid, p.8.

## *Interviewees*

Peter Baki
Deputy Secretary
Department of Education
PSA Haus, FMBS
Boroko, N.C.D.

Damien Rapese
First Assistant Secretary
Special Education Service
Department of Education
PSA Haus, FMBS
Boroko, N.C.D.

Godfried Yerua
Assistant Secretary/Curriculum
Curriculum Development Division
Department of Education, FMBS
Boroko, N.C.D.

John Yareki
Broadcast Policy Liaison Officer
Department of Education
PSA Haus, FMBS
Boroko, N.C.D.

Tom Seta
Senior Research Officer
Research and Evaluation Unit
Department of Education
PSA Haus, FMBS
Boroko, N.C.D.

Ben Kuop
Executive Producer
National Broadcasting Company
P.O. Box 1359
Boroko, N.C.D.

Jocelyn Patterson
Education Officer
National Broadcasting Company
P.O. Box 1359
Boroko, N.C.D.

John Honani
Research Officer
National Broadcasting Company
P.O. Box 1359
Boroko, N.C.D.

Hitolo
Schools Broadcasts Supervisor
Department of Education
Standards Building, FMBS
Boroko, N.C.D.

Paul Mungul
Radio Producer
Department of Education
Standards Building, FMBS
Boroko, N.C.D.

Patrick
Senior Technician
Department of Education
Standards Building, FMBS
Boroko, N.C.D.

Harold Ure
Curriculum Officer-Science
Curriculum Development Division
Department of Education, FMBS
Boroko, NCD

Mark Sisa
Audio Visual Unit
Department of Education
Standards Building, FMBS
Boroko, NCD

Lidia
Radio Science Scriptwriter
Audio Visual Unit
Department of Education
Standards Building, FMBS
Boroko, NCD

Bernie Naiab
Headmaster
Lakomiufa Community School
P.O. Box 880
via Goroka, E.H.P.

William Iga
Grade Six Science Teacher
Lakomiufa Community School
P.O. Box 880
via Goroka, E.H.P.

Lorna Pinor
Grade Five Science Teacher
Lakomiufa Community School
P.O. Box 880
via Goroka, E.H.P.

Renagi Ralai
Headmaster
Asaro Community School
P.O. Box 880
via Goroka, E.H.P.

I. Onafimo
Headmaster
Manto Community School
P.O. Box 880
via Goroka, E.H.P.

M. Sipio
'92 Grade Six Science Teacher
Manto Community School
P.O. Box 880
via Goroka, E.H.P.

H. Olobanawe
'94 Grade Six Science Teacher
Manto Community School
P.O. Box 880
via Goroka, E.H.P.

H. Herepe
'93 Grade Six Science Teacher
Manto Community School
P.O. Box 880
via Goroka, E.H.P.

Toni Gimi
Headmaster
Marinumbo Community School
P.O. Box 107
via Maprik, E.S.P.

John Meombi
Headmaster
Bagiman Community School
P.O. Box 107
via Wewak, E.S.P.

Ivo M. Aundambui
'92 Grade Six Science Teacher
Sangriman Community School
P.O. Box 107
via Wewak, E.S.P.

Andrew Kiku
Grade Six Science Teacher
Kasmin Community School
via Angoram, E.S.P.

Frank Watson
Radio Science Project Coordinator
RFD #1, Box 7630
Underhill, VT 05489 USA

Ann Watson
Radio Science Scriptwriter Trainer
RFD #1, Box 7630
Underhill, VT 05489 USA

Roland Katak
Former Radio Science Evaluator
c/- UNICEF
P.O. Box 472
Port Moresby, N.C.D.

## *References*

Currin, Charles, "The Radio Science Project: Evaluation Issues and Evaluation Design," PNG National Department of Education, December, 1987

Galda, Klaus, Roland Katak, and Frank Watson, Report on Summative Evaluation of Grade Four Radio Science, RSPP Discussion Paper, 1990

Imhoof, Maurice and Philip R. Christensen, eds, *Teaching English by Radio: Interactive Radio in Kenya*, Washington, D.C., Academy for Educational development, 1986

Katak, Roland, "Crime and Summative Evaluation of RSPP in East Sepik," RSPP Discussion Paper, 1989.

Letter from Paul Mungul, Radio Producer, PNG Department of Education, to Dolores Alvino, Education Development Center, June, 1993.

Letter from Ambassador Ferrand to AIDAC for R&D/ED, USAID, May, 1993.

"Memorandum of Agreement Between the Government of Papua New Guinea and the Education Development Center," USAID, March, 1986.

Moulton, Jeanne, *Interactive Radio Instruction: Broadening the Definition*, LearnTech Case Study Series, No.1, January, 1994

Olsson, Micael, "Papua New Guinea Radio Science Pilot Project Evaluation", Office of Education, Bureau of Science and Technology, USAID, June, 1989.

Olsson, Micael, Francine Marshall, Pablo Maldonado, and Marie Laurion, "Learning Technologies for Basic Education: External Evaluation", Creative Associates International, Agency for International Development, November, 1993

*Radio Science Grade Six: Children's Science Book*, Papua New Guinea Department of Education, 1990.